

## WILDLIFE CASUALTIES ON THE HIGHWAYS

BY DAYTON STONER

During the past several years the ever-increasing motor car traffic on our highways has attracted universal attention. The attendant effect that this traffic has had upon our wildlife also has elicited comment both in the daily press and in technical and semitechnical publications. Several contributions on the subject have appeared from the pen of the present writer.

My own latest figures obtained on an extended automobile trip across the eastern half of the United States, together with a desire to organize and analyze briefly the results obtained on previous lengthy trips by myself and others prompts the present offering.

In the course of a round-trip automobile journey between Albany, New York, and Iowa City, Iowa, involving a total of 2,158 miles, Mrs. Stoner and I kept a record of the larger vertebrate animals lying dead on the highways. Without doubt these forms had met death in the passing motor traffic, most of them apparently within the twenty-four hours preceding our passing. The going journey was made between September 21 and 24, 1935; the return, September 29 to October 2, all dates inclusive. Our findings are set forth in Table 1.

From the above figures the casualty rate per mile by States or Provinces is as follows: Iowa, .500; Indiana, .442; Ohio, .374; Illinois, .256; Michigan, .146; New York, .142; Ontario, .129; Pennsylvania, .031.

Strange as it may appear the highest casualty rate occurs in the agricultural states, the four highest being, respectively, Iowa, Indiana, Ohio, and Illinois. However, it should be noted also that in these states, on the average, the casualties were high not so much among *wild* life as among domesticated and semidomesticated forms, particularly domestic fowls, cats, and the English Sparrow. On the other hand, the death rate per mile in the cottontail rabbit was higher in Ohio (.047) and Indiana (.047) than in any other states through which we passed. The per mile reptile casualties also were highest in Iowa (.161) with Michigan (.050), New York (.038), and Indiana (.035) following.

One of the interesting points about such counts is the way that they appear to illustrate the local prevalence of certain species of animals. For example, it will be noted that, of the 116 English Sparrows identified with certainty, 61 per cent (72 individuals) were recorded on the 616 miles traveled in Illinois and Indiana. General

TABLE 1. Counts of Vertebrate Casualties Observed on the Highways.  
Albany, New York, to Iowa City, Iowa, September 21-25, 1935;  
and Return, September 29-October 2, 1935.

	State or Province and Mileage Traveled in Each								Totals
	Ontario 247	Illinois 363	Indiana 253	Iowa 118	Michigan 157	New York 673	Ohio 251	Pennsylvania 96	
AMPHIBIANS									
Frogs .....					1	1			2
REPTILES									
Painted terrapin .....	2		2	5		3			12
Milk snake .....						1			1
Bull snake .....		1	1	2					4
Green snake .....			1		2				3
Garter snake .....			1	1					2
Ribbon snake .....					1				1
Miscellaneous (may include some of above).....		6	4	11	4	21	6	2	54
BIRDS									
Virginia rail .....				1					1
Domestic fowl .....		12	9	11		3	8		43
Domestic pigeon .....				1					1
Eastern mourning dove.....			1						1
Northern flicker .....					1				1
English sparrow .....	7	31	41	6	2	7	22		116
Miscellaneous (may include some of above).....	5	18	10	8	4	11	22		78
MAMMALS									
Opposum .....			1	3			1		5
Weasel .....						1			1
Common skunk .....	4	2	5	3		30	6		50
Domestic dog .....		1						1	2
Domestic cat .....	2	5	11	1	2	4	7		32
Red squirrel .....							1		1
Gray squirrel .....			1			3			4
Fox squirrel .....			2						2
Pocket gopher .....		1							1
Meadow mouse ( <i>Microtus</i> ?).....	1						1		2
Muskrat .....			1	1	1	2			5
Brown rat .....	1					1	1		3
Jumping mouse .....	1								1
Cottontail rabbit .....	4	6	12	1	3	5	12		43
Miscellaneous (may include some of above).....	5	10	9	4	2	3	7		40
Totals.....	32	93	112	59	23	96	94	3	512

field observations in this highly agricultural section attest to the extreme prevalence of this foreign element in its bird population.

Similarly, of the fifty bodies of common skunks observed in the highway on this trip, 60 per cent (30 individuals) were recorded on the 673 miles traveled in New York State. As a matter of fact, 93 per cent of these (28 individuals) were met with on approximately 400

miles of New York State highway west of Syracuse (September 21 and October 1 and 2).

In our 1935 round-trip count, as in our one-way count made in 1934 on approximately the same highway<sup>1</sup>, the common skunk was the most frequent casualty observed among the mammals.

An interesting sidelight is worthy of mention in this connection. On October 26, 1935, in again motoring over a part of the same New York State highway traversed on October 1 and 2, we counted fifteen dead skunks, most of them freshly killed, between Batavia and Geneva, a distance of sixty-five miles. This death toll is at the rate of about one skunk for each four miles of travel and is, of course, much higher than the average for this species over the entire trip.

It is a matter of common observation that the cottontail rabbit is a frequent victim among highway wild life casualties. My own counts bear this out. In fact the figures seem to indicate that this mammal is more generally and evenly distributed than the common skunk. This statement, too, I believe, is borne out by the recorded field observations.

The above table shows twenty-one snake casualties on the 673 miles traveled in New York State. It should be pointed out, however, that this entire lot actually was recorded on the approximately 235 miles of highway between Syracuse and the extreme southwestern border of the state via Geneva, Dansville, Olcan, and Jamestown. This is largely mountainous or hilly country and rather sparsely populated in the rural sections.

It may now be of interest to compare the findings as recorded by Messrs. William H. Davis<sup>2</sup>, W. A. Dreyer<sup>3</sup>, and the present writer<sup>4</sup> on rather lengthy automobile trips through more or less similar country. In Table 2 I have taken the liberty of tabulating in condensed form their data, including those above presented by myself for the first time. This tabulation illustrates graphically the factual rate of killing on some 8,000 miles of highway on which the counts were made.

It will be observed that on the writer's 1934 trip of 1,063 miles no effort was made to count other than mammalian casualties. Had the other vertebrate casualties actually been counted the total for the trip would have been considerably augmented. A more or less obvious deficiency also appears in the "Amphibians" column of Table 2

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<sup>1</sup>Stoner, D. *Science*, 81:401-402, 1935.

<sup>2</sup>*Science*, 79:504-505, 1934.

<sup>3</sup>*Ibid.*, 82:439-440, 1935.

<sup>4</sup>*Ibid.*, 61:56-58, 1925; *Ibid.*, 69:670-671, 1929; *Ibid.*, 81:401-402, 1935.

TABLE 2. Condensed Tabular Summary of Vertebrate Casualties Recorded on 8.303 Miles of Highway.

Date	Observer	Locality	Mileage	Mammals	Birds	Reptiles	Amphibians	Miscellaneous	Total	Average per Mile
1924 June and July	Stoner	Iowa: Iowa City to Lake Okoboji and Return	632 <sup>5</sup>	43	142	40	....	....	225	.356
1928 October	Stoner	Iowa to Florida	1400 <sup>6</sup>	45	67	81	6	35	234	.167
1933 "Summer"	Davis	Iowa to Massachusetts	500 <sup>7</sup>	64	60	12	13	30	179	.358
1934 October	Stoner	Iowa to New York	1063	66 <sup>8</sup>	.....	.....	.....	.....	66	.062
1935 June, July and September	Dreyer	Illinois to Massachusetts and Return to Cincinnati, Ohio	2550	25	9	21	....	6	61	.024
1935 September and October	Stoner	Albany, N. Y., to Iowa City, Iowa, and Return	2158	192	241	77	2	....	512	.237
			8303	435 <sup>6</sup>	519	231	21	71	1277	.153

<sup>5</sup>Stoner, D., *loc. cit.* 1925.

<sup>6</sup>Stoner, D., *loc. cit.* 1929.

<sup>7</sup>Records cited for only 500 miles.

<sup>8</sup>Stoner, D., *loc. cit.* 1935. Mammals only counted.

for I believe that many frogs and toads are overlooked by observers. These forms are comparatively small, they have no outstanding exoskeletal features and their bodies are soft and yielding so that even immediately following death by motor traffic little of the animal remains except an inconspicuous splotch of red or a moist spot in the highway. For this reason also I suspect that *all* counts are probably lower than actually should be the case. If the degree of this deficiency could be even approximated I feel sure that the figures on the *rate* of killing would be materially increased.

Notwithstanding whatever deficiencies may exist in these records, they show that a total of 1,277 dead vertebrates was counted by three different observers on 8.303 miles of highway—mostly paved—extending through rather diversified habitat mainly in the northern half of the country lying east of the Mississippi River. This is an average of .153 casualties per mile, more than six times the average destruction recorded by Dreyer, but approximately one and one-half times less than the average for the writer's 1935 trip and about two and four-tenths times less than for his 1925 figures from Iowa.

In the light of the previous discussion the average of .153 vertebrate casualties per mile probably more closely approximates the truth than any one of the trip records cited. From my own observations over a wide territory within the past ten years I am inclined to believe that an average daily motorcar casualty list of something more than 200 vertebrates per 1,000 miles of main traveled highway is a fair approximation of the true conditions which prevail during summer and early autumn.

Whether this situation prevails throughout the country as a whole we have yet to learn. That it does not prevail during spring and winter in the Northern States at least, can not be doubted. But it is questionable whether we are justified in applying the current findings of vertebrate death rates on a per diem basis to the 750,000 miles of improved roads throughout the United States.

As suggested by Dreyer<sup>9</sup>, "The rate of killing may vary greatly from year to year, and also within a single season, probably in relation to marked departures from the normal temperature, humidity, and precipitation, or in relation to seasonal activities of the animals." Without doubt this is true. Such details then, as breeding habits, time of molt, imminence, direction and abundance of the food supply from nesting places, the gregarious tendency or lack of it, extent of diurnal or nocturnal wanderings as well as a host of other and possibly incidental factors also probably play an important rôle in the results that we obtain.

However, Dreyer's theory that hot, dry summers produce "a restless, exploratory activity" on the part of animals thus causing them to wander and bring them more in contact with highway traffic is not borne out in the findings recorded in Table 2. For example in the "hot, dry" summer of 1933, Davis recorded 64 mammals on 500 miles of highway (.128 individuals per mile), while in the torrid summer of 1934 the writer recorded 66 mammals on 1,063 miles (.062 individuals per mile). In the more "normal" summer of 1935 the writer recorded 192 mammals on 2,158 miles of highway which is at the average rate of .088 individuals per mile. Essentially the same results are to be noted among the birds and reptiles as recorded by Davis for 1933 and those of the writer for 1935.

As pointed out above, Dreyer's records for 1935—a "normal" season—are considerably lower than those of Davis for a hot season,

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<sup>9</sup>*loc. cit.*, 439.

or of the writer for another hot season (mammals only compared), or of the writer for the same (1935) season.

After all, in view of the rather limited amount of information that we have on this subject, we are scarcely justified in drawing too widespread and sweeping conclusions. We are not ready for elaborate theorizing or broad application of our findings to a large territory. Let us carefully and conscientiously *amass* the facts and findings, leaving the matter of speculation in the distant, inconspicuous background of the picture.

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